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PLASTIC CONTAINER WITH ELECTRIC DISSIPATION CAPABILITY

[0001] The invention relates to an industrial packaging container of plastic (HD-PE) such as e.g. a bunged drum, a lidded drum, a jerrican, or an inner container for a pallet container (IBC). Such packaging containers or drums are used for storage and transport in particular of combustible or explosive liquid or solid contents.

[0002] A bunged drum typically includes a cylindrical drum wall, a disk-shaped drum bottom end, and a respective drum top end. Provided in the transition zone between drum wall and drum top is a circumferential carrying and transport ring (handling ring = L-ring). The drum top end has formed therein at least one bung opening which is arranged in a recessed bunged housing (bung depression) and has an upright bung fitting. The upper open drum body of a lidded drum is closed by an attached drum lid and tension ring. The drum lid may also be provided with bung openings. Jerrican and IBC inner container are closed by respective screw caps.

[0003] Any packaging container useful for storage and transport of especially hazardous liquid contents must be inspected by an official authority and approved. The container has to meet certain requirements and exhibit, for example, sufficient stacking stability, drop resistance and tightness.

[0004] When using the packaging container for combustible contents or liquids, care should be taken to avoid electric charge buildup and spark formation during manipulation of the container, in particular during filling or emptying, so as to prevent explosion of evaporating gas mixtures.

[0005] It is therefore an object of the present invention to provide an industrial packaging container of the afore-stated type for storage and transport of especially combustible contents (liquids), having a particular construction to allow use in explosive areas.

[0006] This object is attained by a packaging container (electrically dissipative plastic container) in such a manner that an electric connection is established between the inside content and the bottom end, upon which the packaging container rests, so that an explosive electrostatic charge buildup of the content and/or the container body is prevented and the electrostatic charge buildup is securely transmitted into the bottom end.

[0007] The dependent claims set forth further advantageous structural modifications of the invention.

[0008] The construction of the dissipative plastic container is characterized in particular by:

- realizing the electroconductive connection between the liquid content and

the conductive outer container layer via a permanently installed conductive dissipator rod and via a screwed, also conductive, bung plug in which the dissipator rod is inserted and which, when screwed in, is in electric contact with the conductive outer side of the drum body,

- making the length of the dissipator rod longer by about between 3 % and 30 % than the height of the container so that the dissipator rod extends from the conductive bung plug to the most remote area of the container bottom end,
- realizing the electric connection between the liquid content inside and the electroconductive outer side of the container body via a special further screw plug which is also conductive and screwed into the bottom end of the container body,
- realizing the electric connection between the liquid content inside and the electroconductive outer side of the container body via a special plug which is made of conductive plastic and welded or injection-molded into the bottom end of the container body,
- realizing the electric connection between the liquid content inside and the electroconductive outer side of the container body via at least one wall dimple provided, preferably, in the bottom end of the container body, whereby the outer layer made of conductive plastic is formed into the interior of the drum body and is brought into contact with the liquid content.

[0009] Further important and essential features of the introduced novel packaging container according to the invention are shown in the drawings.

[0010] Exemplified embodiments of the invention will now be described in detail with reference to the drawings, in which:

[0011] FIG. 1 shows a bunged drum of plastic in accordance with the invention,

[0012] FIG. 2a shows a bung plug with attached dip tube,

[0013] FIG. 2b shows a bung plug of the bunged drum according to FIG. 1,

[0014] FIG. 2c shows the bung plug screwed into the bung fitting,

[0015] FIG. 3a shows a sealing cap for a bung plug,

[0016] FIG. 3b shows a bung plug with attached sealing cap and inserted dip tube,

[0017] FIG. 3c shows another bung fitting,

[0018] FIG. 3d shows the bung plug according to FIG. 3b, screwed into the bung fitting,

[0019] FIG. 4a shows a particular bottom bung fitting,

[0020] FIG. 4b shows an enlarged illustration of the bottom bung fitting screwed into the drum bottom end according to FIG. 4a,

[0021] FIG. 5a shows a particular bottom plastic plug,

[0022] FIG. 5b shows the plastic plug according to FIG. 6a, inserted in the drum bottom end,

[0023] FIG. 6a shows a plastic plug connected with an outer layer,

[0024] FIG. 6b shows an enlarged illustration of the plastic plug according to FIG. 6a, disposed in the drum bottom end,

[0025] FIG. 7a shows a particular configuration of the outer plastic layer guided inwardly,

[0026] FIG. 7b shows an enlarged illustration of the inwardly guided outer plastic layer according to FIG. 7a, and disposed in the drum bottom end,

[0027] FIG. 8 is a partial section view in the drum top end / bung zone,

[0028] FIG. 9 is a partial section/side view of another bunged drum,

[0029] FIG. 10 is a side view of a pallet container according to the invention,

[0030] FIG. 11 is partial section view of a pallet container,

[0031] FIG. 12 is a side view of a plastic container according to the invention, and

[0032] FIG. 13 is a side view of a plastic jerrican according to the invention

[0033] FIG. 1 shows, by way of example, a two-layer 220 liter plastic drum (220 liter L-ring drum PLUS, electrically dissipative) made by a coextrusion blow molding process and protected electrostatically by a conductive outer plastic layer 12 and an electric connection between the liquid (content) and the conductive outer layer. The inner, non-conductive plastic layer 14, which is in contact with the content, is made of neutral plastic (HD-PE). The drum outside (e.g. black outer plastic layer through addition of soot) is made across the entire surface thereof of a conductive plastic (surface resistance 1.1 k Ω to 1.4 k Ω). In this way, a secure electric connection between the liquid inside and the electroconductive outside of the drum body is established. The electroconductive connection between the liquid and the conductive outer container layer is realized by a permanently installed conductive dip tube 18 as electric dissipator rod and via a screwed, also conductive, bung plug 18 in which the dip tube is inserted and which, when screwed in, is in contact with the conductive outer side

of the drum body (measured resistance to ground smaller 100 k Ω at 10 V). The dip tube should hereby touch the drum bottom, and for that purpose may be provided at the lower end, preferably with a yielding, bellow-like tube tip to ensure that the dip tube extends in any case to the inner drum bottom.

[0034] FIG. 2a shows a bung plug 18 of electroconductive plastic in which the dip tube 16 is inserted.

[0035] FIG. 2b shows an enlarged view of the bung fitting of the plastic drum 10 to illustrate the extension of the outer electroconductive layer 12 of the drum wall up to the upper rim of the bung fitting. As a result – as shown in FIG. 2c – an electroconductive connection is ensured from the dip tube 16 to the outer layer 12 of the container wall, when the bung plug 18 is screwed on.

[0036] FIG. 3a illustrates a metallic cover cap 20 (= sealing cap), and FIG. 3b shows a bung plug with inserted dip tube 16, designed here as round bar of conductive plastic solid material, and attached clinch ring 22 (= contact ring).

[0037] FIG. 3c shows the pertaining bung fitting, while FIG. 3d shows all components being assembled. The clinch ring 22 permanently secures the screwed bung plug 18 with dip tube 16 in the bung fitting of the drum, with the clinch ring 22 and the attached cover cap 20 establishing the electric connection to the conductive outer layer 12 of the drum.

[0038] FIG. 4a and FIG. 4b show a modification of the invention in which the electric connection between the liquid inside and the electroconductive outer side 12 of the container body is realized by a particular further bottom bung plug 24 which is screwed into the bottom end of the container body and also made conductive (measured resistance to ground about 450 k Ω at 10 V).

[0039] According to another variation - illustrated in FIG. 5a and FIG. 5b - the electric connection between the liquid inside and the electroconductive outer side 12 of the container body is realized by a special plug 26 made of conductive plastic (measured resistance to ground about 100 k Ω at 10 V) and welded into the bottom end of the container body.

[0040] According to another variation - illustrated in FIG. 6a and FIG. 6b - the electric connection between the liquid inside and the electroconductive outer side 12 of the drum body is realized by a special plug 28 made of conductive plastic and injection-molded into the bottom end of the container body. The conductive plastic of the plug 28 is made of the same material as the outer layer 12 of the bunged drum.

[0041] According to another variation - illustrated in FIG. 7a and FIG. 7b - the electric connection between the liquid inside and the electroconductive outer side 12 of the container body is realized by at least one wall dimple 30, provided preferably in the bottom end of the container drum, whereby the outer layer 12,

which is made of conductive plastic, is formed into the interior of the container body and brought into contact with the liquid content. The wall dimple 30 may be realized in the blow mold by means of a particular mandrel (= mold slide).

[0042] FIG. 8 shows a particular venting bung plug 32 with vent openings 36 and with suspended dip tube 16, with the venting of the drum being implemented by removing an inner smaller screw plug 34. Emptying of the drum requires only removal of the sealing cap 20 (original closure), while the clinch ring 22 remains upon the bung fitting or bung plug.

[0043] FIG. 9 depicts a particular configuration of the dip tube 16. The dip tube 16 or the dissipator rod is designed longer by about between 3 % and 30 % than the height of the container so that the dissipator rod is able to extend from the conductive bung plug to the most remote region of the container bottom end.

[0044] FIG. 10 shows a pallet container (IBC) 38 having a thin-walled plastic inner container configured with the features according to the invention. As further shown in FIG. 11, the electrically conducting dip tube 16 is equipped here with a bellow-like inner tip to ensure a secure contact with the bottom end of the inner container.

[0045] FIG. 12 shows as further exemplified embodiment a 60 liter plastic container, and FIG. 13 illustrates a 20 liter plastic jerrican with electrically conducting outer layer.

[0046] The container body may also be designed with three layers, with only the outer layer being electroconductive. The inner layer is made of typical natural undyed plastic (new material without color additives and UV stabilizers), while the middle layer may be made of another material, such as, e.g., recovered pellets (material recovered from used plastic containers).

[0047] The electroconductive layers or parts are made of electroconductive plastic material, e.g. additives like TiO₂, nano-clay, soot, nano-composite, metal fibers or are covered with a conductive varnish.

[0048] In case of need, e.g., when the conductive outer layer is blackened with soot, the plastic container may be provided with one or more viewing strips, whereby the viewing strips have preferably limited length and extend only across the vertical wall region.

[0049] The measures according to the invention assure a permanent electric connection between the content and the container outside or the support surface upon the ground even in a most detrimental situation, e.g. when the container is half empty or the drum lies on the side. The electrically charge

dissipating container should hereby stand across its entire surface with the conductive plastic outer side upon the bottom (ground).